Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

SEDIMENT BASIN

CODE 350

(no)

DEFINITION

A basin constructed with an engineered outlet, formed by constructing an embankment, excavating a dugout, or a combination of both.

PURPOSE

This practice is used to accomplish the following purpose:

- To capture and detain sediment-laden runoff, or other debris for a sufficient length of time to allow it to settle out in the basin

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to urban land, construction sites, agricultural land, and other disturbed lands where—

- Physical conditions or land ownership preclude treatment of a sediment source by the installation of erosion-control measures.
- A sediment basin offers the most practical solution.
- Failure of the basin will not result in loss of life, damage to homes, commercial or industrial buildings, main highways or railroads; or in the use of public utilities.
- The product of the storage times the effective height of the dam is less than 3,000. Storage is the volume, in acre-feet, in the reservoir below the elevation of the crest of the auxiliary spillway.
- The effective height of the dam is 35 feet or less. The effective height of the dam is the difference in elevation between the auxiliary spillway crest and the lowest point in the cross section taken along the centerline of the dam.
- The dam is classified low hazard according to section 520.21(E) of the NRCS National Engineering Manual (NEM).

CRITERIA

General Criteria Applicable to All Purposes

Plan, design, and construct the sediment basin to comply with all applicable Federal, State, and local laws and regulations.

Location

Sediment basins provide the last line of defense for capturing sediment when erosion has already occurred. When possible construct the basin prior to soil disturbance in the watershed. Choose the location of the sediment basin so that the basin intercepts as much of the runoff as possible from the disturbed area of the watershed. Choose a location that minimizes the number of entry points for runoff into the basin and interference with construction or farming activities. Do not locate sediment basins in perennial streams.

Storage Capacities
The sediment basin must have sediment storage, detention storage, and temporary flood storage capacities as follows:

- Design a minimum sediment storage capacity equal to the design life of the structure, or provide for periodic cleanout.
- For maximum sediment retention, design the basin so that the detention storage remains full of water between storm events. However, if site conditions, safety concerns, or local laws preclude a permanent pool of water, provide for dewatering of all or a portion of the detention and sediment storages between storm events.
- Design flood storage based on the required design storm for the auxiliary spillways. Provide a minimum of 1 foot in elevation between the principal and auxiliary spillways.
- Calculate the sediment storage volume from the bottom of the basin to the top of the sediment storage.
- Calculate the detention volume from the top of the sediment storage to the crest of the principal spillway.
- Calculate the flood storage between the crest of the principal spillway and the crest of the auxiliary spillway.

Principal and Auxiliary Spillway Design
Design the principal and auxiliary spillways as follows:

- Design the principal spillway to carry long-duration, continuous, or frequent flows without discharge through the auxiliary spillway.
- The principal spillway can be designed to remove only water from the temporary flood storage or it can be designed to dewater all or part of the detention storage.
- Design the principal spillway to drawdown the temporary flood storage within 24 hours. Drawdown times for the detention storage can be longer to improve sediment trapping.
- Use a principal spillway pipe 6-inches diameter or greater.
- Provide a stable outlet of the principal spillway for anticipated design flow conditions.
- Provide means such as perforations or small openings in the principal spillway riser when dewatering all or a portion of the detention and sediment storages.
- Design the auxiliary spillway to pass large storms without damage to the basin.

Refer to criteria in NRCS Conservation Practice Standard (CPS) Pond (Code 378), for the required design criteria for the principal and auxiliary spillways.

Basin Shape
Design the sediment basin with a length-to-width ratio of 2 to 1 or greater. If needed, use baffles to divert the flow in the basin to lengthen the flow path of incoming water to achieve the required length-to-width ratio.

Embankment and Side Slopes
If the sediment basin includes an embankment, refer to criteria in CPS Pond (Code 378), for design requirements.

Provide side slopes of the pool area 3 horizontal to 1 vertical, or flatter, above the permanent waterline, and 2 horizontal to 1 vertical, or flatter, below the permanent waterline.

Safety
Design measures necessary to prevent serious injury or loss of life in accordance with requirements of NRCS NEM, Part 503, Safety.

Vegetation and Soil Protection
Seed or sod the exposed surfaces of earthen embankments, earth spillways, borrow areas, and other areas disturbed during construction in accordance with the criteria in CPS Critical Area Planting (Code 342). When necessary to provide surface protection where climatic conditions preclude the use of seed or sod, use the criteria in CPS Mulching (Code 484), to install inorganic cover material such as gravel.

Cultural Resources
Evaluate the existence of cultural resources in the project area and any project impacts on such resources. Provide conservation and stabilization of archeological, historic, structural, and traditional cultural properties when appropriate.

CONSIDERATIONS

General Considerations
A large sediment basin may have an effect on the peak discharge rate from a watershed. Planners should consider this, and take steps to mitigate any potential negative effects this may have on riparian habitat downstream from the structure.

In many cases, the use of a sediment basin alone may not provide sufficient protection for offsite sedimentation problems. To work most effectively, the sediment basin should be the last practice in a series of erosion control and sediment capturing practices installed in the disturbed area. This incremental approach will reduce the load on the basin and improve effectiveness of the overall effort to prevent offsite sedimentation problems.

Many factors influence the efficiency of sediment removal in a basin. These include the detention time of runoff, the type of dewatering device, the presence of a permanent pool in the basin, a decrease in turbulence in the basin, and soil particle size. Use the following techniques as needed to remove clay and other fine-grained particles.

- Increase detention time by increasing the storage volume in the basin. Increased storage along with a properly designed dewatering device can significantly improve the efficiency of sediment capture.
- Dewater in a manner that removes the cleaner water above the sediment storage, without removing the sediment-laden water found deeper in the basin. The use of a skimming device that floats on the surface and adjusts to water level changes can improve the quality of the water leaving the basin. The “North Carolina Erosion and Sediment Control Planning and Design Manual” provides details for this type of dewatering device.
- Maintaining a permanent pool also improves sediment trapping by reducing the resuspension of sediment in the basin. Only dewatering the temporary flood storage or a portion of the detention storage can accomplished this goal. Removal of sediment from the basin before it reaches the sediment storage elevation will maintain the pool volume and improve trapping efficiency.
- Reduce turbulence in the basin by constructing porous baffles that extend across the entire basin. The baffles slow down flows and force water to spread across the entire width of the basin. The “North Carolina Erosion and Sediment Control Planning and Design Manual” contains a thorough discussion and design criteria for porous baffles.
- For very fine-grained sediments, add flocculants to the runoff before it enters the basin. One commonly used flocculant is anionic polyacrylamide (PAM). Do not use cationic polyacrylamide because it can be toxic to aquatic life.

Diverting runoff from undisturbed areas away from the basin will improve the function of the basin. The design storm for diversion measures should be equal to the design storm for the auxiliary spillway of the basin.

Use forebays, separate from the main basin and easily accessible for cleanout, to reduce turbulence and allow larger particles to settle out of the runoff before it enters the main basin.

Because the sediment storage capacity of a basin is finite, choose a location that allows access for sediment removal when the storage capacity is full.

Visual resource design

Carefully consider the visual design of sediment basins in areas of high public visibility and those associated with recreation. The shape and form of ponds, excavated material, and plantings are to relate visually to their surroundings and to their function.

Shape the embankment to blend with the natural topography. Shape the edge of the pond so that it is generally curvilinear rather than rectangular. Shape excavated material so that the final form is smooth, flowing, and fitting to the adjacent landscape rather than angular geometric mounds. If feasible, add islands to provide visual interest and to attract wildlife.

Changed Use

In some situations, after they have served the sediment capture function, sediment basins may remain in place to function as stormwater detention or wildlife ponds. This requires appropriate planning during the design phase to ensure that the basin can function for a different use. This may also require significant modifications to outlet structures as well as removal of accumulated sediment to convert it to a new use.

Use by Wildlife

If the basin will be used by wildlife, the use of native species is recommended to provide food and habitat diversity. Also, consider wildlife use of the basin when scheduling maintenance activities that may disrupt wildlife life cycles or negatively impact pollinators.

PLANS AND SPECIFICATIONS

Prepare plans and specifications that describe the requirements for applying the practice according to this standard. As a minimum, include the following items:

- A plan view of the layout of the sediment basin.
- Typical profiles and cross sections of sediment basin.
- Details of the outlet system.
- Structural drawings adequate to describe the construction requirements.
- Requirements for vegetative establishment and/or mulching, as needed.
- Safety features.
- Site-specific construction and material requirements.

OPERATION AND MAINTENANCE

Prepare an operation and maintenance plan for the operator.

As a minimum, include the following items in the operation and maintenance plan:

- Periodic inspections of all structures, earthen embankments, spillways, and other significant appurtenances.
- Prompt removal of trash from pipe inlets and trash racks.
- Prompt repair or replacement of damaged components.
- Prompt removal of sediment when it reaches predetermined storage elevations.
- Periodic removal of trees, brush, and undesirable species.
- Periodic inspection of safety components and immediate repair if necessary.
- Maintenance of vegetative protection and immediate seeding of bare areas as needed.

REFERENCES

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